



CSIR NEWS

VOL. 27

A FORTNIGHTLY HOUSE BULLETIN OF CSIR

15 NOVEMBER 1977

NO. 21

Domestic Fuel from Assam Coal

In the north-eastern region, firewood is used as a major fuel for domestic purposes. Kerosene and LPG are used only by a section of the population in the urban areas. Assam coal is not used as domestic fuel because of its high volatile matters and high sulphur content. Owing to the use of firewood as a fuel the forests in the north-eastern region are gradually getting depleted. The Regional Research Laboratory (RRL), Jorhat, investigated the possibilities of finding an alternative fuel for industry and domestic purposes using the coal of north-east region which has not found industrial utilization because of the peculiar characteristics. The North-Eastern Coal Fields of Coal India Ltd (CIL) have shown interest in the process developed by RRL for utilization of Assam coal as a fuel, and have signed an agreement with the laboratory for producing large quantities of nodules/pellets for market studies. CIL have installed a 200 kg/hr nodulization unit at Margherita for enabling distribution to interested parties, including tea gardens and other industries, for assessing consumer acceptability. They are providing combustion appliances to the parties concerned and demonstrating the combustion to the extent possible. As and when the consumer acceptability and the market demand are established, the process will be released to North-Eastern Coal Fields for commercial exploitation.

The average heating value of the nodules will be 10,000 Btu/lb. About

25 paise worth of nodules will be sufficient for a family of four to cook their meals twice a day.

Cultivation of Medicinal Plants in Senua Village

The Regional Research Laboratory (RRL), Jorhat, in collaboration with the Arunachal Pradesh Administration, has embarked on a scheme for cultivation of medicinal and essential oil bearing plants in the Senua village in Tirap district of Arunachal Pradesh. Already five acres of land have been brought under the cultivation of *Solanum khasianum*. The seeds obtained from this crop will be utilized for bringing another 20-25 acres of land under *Solanum* cultivation in the coming year, involving about 150 tribal families of the village. Besides *S. khasianum*, various essential oil bearing plants such as *Mentha species*, lemongrass, citronella, patchouli and *Eucalyptus citriodora* have been introduced in Senua and their performance is under observation. A tribal youth from the village has been imparted adequate training to handle the various aspects of the cultivation of these plants under the supervision of the laboratory.

The medicinal plants project in Senua is part of RRL's efforts for the development of the hill areas of north-eastern India through the application of science and technology. Situated at an altitude of about 6000 ft, this village lacks the basic infrastructure for any industry, but the laboratory visualized that natural resources of this village, namely manpower, fertile land

and rainfall, could be harnessed to establish a base for phytochemical industry, and through the participation of the villagers in this type of gainful employment, the process of socio-economic transformation could be set in. Further, this type of cultivation is likely to discourage the traditional Jhum cultivation which causes soil erosion with consequent ecological imbalance.

It is proposed to involve more people during the next season by individual cultivation of *S. khasianum*, for which the necessary guidance and planting material will be provided by the laboratory. RRL is also negotiating with entrepreneurs for installation of a plant near Senua for extraction of solasodine from the berries, to provide a sustained market to the producers. Until such a plant comes up the laboratory will arrange selling of the produce to industry. Solasodine, which is a key raw material for synthesis of steroids, particularly contraceptive pills, enjoys a high price of up to Rs 1000/kg.

Information Centre for Food Technology

The Department of Science and Technology of the Government of India has approved the establishment of a Sectoral Information Centre for Food Technology at the Central Food Technological Research Institute (CFTRI), Mysore, as part of the National Information System for Science and Technology (NISSAT). This information centre is being built around the infrastructural facilities already available

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at CFTRI and will be responsible for storage and distribution of food information on a nation-wide basis with special emphasis on small scale, village and cottage industries.

The objectives of the proposed information centre are : to provide information service to institutions and individuals concerned with food science and technology with emphasis on the information requirement of small scale, village and cottage industries; to function as a clearing house for information on all aspects of food science and technology; and to collaborate in the integrated development of various documentation/information systems in food science and technology and related systems in the country as a whole, and function as a feeder to similar international systems.

Among the various information services that are to be rendered by the centre are : specialized current indexing and abstracting services including selected dissemination of information (SDI) services; subject bibliographies; subject union catalogues; information retrieval, on request; information on patents specifications, standards, etc.; information on scientific, technical and economic data; business and marketing information; preparation of surveys, state-of-art reports, scientific and technological forecasting and other types of techno-economic and special management information services; translation services; reprography services; and technical enquiry service.

Recycling of Paper Wastes

A firm in Assam has been given the licence by the National Research Development Corporation of India for the manufacture of low-cost fire-proof roofing sheets by utilizing a process developed jointly by the Regional Research Laboratory, Jorhat, and the Central Building Research Institute, Roorkee. In this process, wastes like street sweepings, straw and bagasse are used as the raw materials.

The product is likely to be marketed by the middle of next year. The mar-

ket price is expected to be about Rs 8/m². Initially the firm will produce about 8 tonnes, about 2000 m², of sheets per day. The total capital outlay for a plant of 8 tonnes per day capacity would be about Rs 25 lakh.

Polyurethane Lacquer for Leather Finishing

Polyurethane lacquer based on TDI-castor oil condensates has been developed at the Central Leather Research Institute (CLRI), Madras, for leather finishing and released to a firm in Bombay for commercial exploitation. The firm is likely to make available the product in the market shortly. Suited for making patent leathers, the lacquer can also be used as a wood-finishing lacquer. The finished surface exhibits high gloss, scratch resistance and weatherability.

The inventors of the lacquer are Dr S. Rajadurai, Shri R. Vedarajan and Prof. M. Santappa.

Arsenic Determination in Drinking Waters

The National Environmental Engineering Research Institute (NEERI), Nagpur, has fabricated a modified glass assembly for the estimation of arsenic. The method is more sensitive than the atomic absorption spectrophotometric method and it is easier to handle the apparatus developed than the apparatus mentioned in the Manual of Standard Methods. At NEERI this apparatus is being used on a routine basis for the quantitative estimation of arsenic in drinking water. The maximum allowable concentration of arsenic in drinking water is 0.05 mg/litre.

The method is based on the reduction of inorganic arsenic to arsine gas by metallic zinc in acid solution in an arsine generator. The determination of arsenic is of importance to public health agencies because of the toxicity of arsenic compounds and also because arsenic in water could be carcinogenic.

Titanium Substrate Insoluble Anodes

NRDC Award-winning Invention

Titanium substrate insoluble anodes (TSIA) have been developed as substitute for graphite anodes at the Central Electrochemical Research Institute (CECRI), Karaikudi. The inventors of the product are Dr H.V.K. Udupa, Dr R. Thangappan, Shri B.R. Yadav and Shri P. Subbiah. Graphite anodes, which are largely consumed in chlor-alkali industries, wear out quickly and consequently there are frequent shutdowns of plants for replacing worn-out anodes, thus resulting in production losses. Moreover, in the conventional chlor-alkali cells, power consumption per tonne of caustic soda produced is fairly high and frequent inter-electrode adjustments have to be made to ensure steady operating conditions. All these disadvantages will be overcome if TSIA are installed in commercial cells (both diaphragm and mercury type). Field trials conducted with these anodes, both in diaphragm and mercury type commercial cells, have established the advantages of TSIA.

The cost of production of caustic soda is expected to come down by Rs 30-100/tonne (depending on cell size and plant capacity) by switching over from graphite anodes to TSIA. A saving to the tune of Rs 26 million is expected to result if the entire Indian chlor-alkali industry switches over to installation of TSIA.

TSIA have potentialities in other industrial applications also. Titanium Equipment and Anode Manufacturing Co. Ltd, Madras, a firm registered in Tamil Nadu with Dr R. Thangappan as scientist-entrepreneur partner, has been granted licence for manufacturing these anodes.

Dr H.V.K. Udupa, Dr R. Thangappan, Shri B.R. Yadav and Shri P. Subbiah have been awarded the Independence Day (1977) award of the National Research Development Corporation of India [CSIR News, 27 (1977), 130].

Seminar on Viscose Fibre and Blending

The Silk & Art Silk Mills' Research Association (Sasmira), Bombay, in association with Unicel Ltd, Zurich, organized a seminar on Viscose Fibre and Blending on 7 September 1977 at Sasmira. More than 300 delegates from the industry and research organizations attended the seminar.

Four papers dealing with general characteristics of viscose staple fibres; spinning viscose rayon staple (100%) and blends, cotton and coarse types; end uses, weaving, dyeing, finishing of viscose rayon yarn staple (100%) and blends; and future prospects for viscose rayon staple, their use in open-end spinning and in non-woven textile structures, were presented by experts from Finland, Austria, Italy and Belgium.

Workshop on R & D Management

A workshop on R & D management was held at the Tocklai Experimental Station of the Tea Research Association (TRA), Jorhat, from 12 to 17 September 1977. The workshop was organized in collaboration with the Management Development Unit (Planning Division) of CSIR. Members from the Administrative Staff College of India, Hyderabad, and Management Development Institute, New Delhi, also participated in the workshop.

The scope of the workshop was delineated broadly in the following three phases : (i) Long-term planning for research in tea industry and organization for tea research priorities; (ii) Techniques of project management, project planning and task force approach, operational planning including network and PERT techniques, evaluation and monitoring of R & D, and project costing and accounting, and (iii) Manpower management in tea research, i.e. personnel management, conflict resolution and motivation for scientists in tea research.

Shri S.K. Mehra, Managing Director, Tata Finlay's Ltd, Calcutta, and

Dr N.K. Jain, Director, TRA, delivered lectures on 'Economic perspective of tea industry' and 'Technological gap in tea research' respectively.

Copolymerization of Ionizable Monomers and Conformational Studies

In the free-radical copolymerization of non-ionizable monomers the kinetic parameters of a particular pair, namely the monomer reactivity ratios (mrrs), are invariant to experimental variations, excepting temperature. Solvent effects, when observed, are minimal. Acrylic acid (AA) and methacrylic acid (MA) polymerize in aqueous solutions, with a strong dependence of the rate of polymerization on the degree of ionization (and hence the *pH* of the medium), ionic strength, temperature, specific and non-specific binding of ions, and electrostatic and hydrophobic interactions. These factors influence the propagation rate constant (K_p) by varying the electrostatic interactions between the reacting species during the ionization of the monomer and the growing copolymer while the termination rate constant (K_t) remains invariant. These influences would be felt in the mrrs of these monomers when these monomers are copolymerized with nonionic hydrophilic monomers like N-vinyl pyrrolidone (NVP) or acrylamide (AM). Such investigations were initiated by Dr S. Prabhakara Rao and carried out by Shri Surendra Ponrathnam under the guidance of Dr S. L. Kapur in the Division of Polymer Chemistry, National Chemical Laboratory, Poona, in the case of binary systems AA-NVP, MA-NVP, AA-AM and MA-AM. These systems were copolymerized to high conversions at 30°C in the *pH* range 2-10 in ion-free water and 1 M NaCl solutions and the mrrs— r_1 (for AA,MA) and r_2 (for NVP, AM)—were evaluated with a well-recognized computer programme.

The mrrs of the acids vary in a systematic way with the *pH* of the medium in ion-free conditions. The r_1 values

are very high at low *pH* when the monomer as well as the growing polymer chain is unionized. Increase in *pH* reduces r_1 values, which pass through a minimum around the *pKa* of the monomer when ionized monomer-monomer electrostatic repulsions are felt and a further minimum around the *pKa* of the polyacid when additional monomer-growing copolymer electrostatic repulsive interactions come into play. Further increase in *pH* results in an increase in r_1 values. The high electrostatic potential around a polyion leads to ion binding, resulting in an enhanced rate of addition of the ionized monomer. Excess of strong electrolyte like 1 M NaCl brings about a complete shielding of the electrostatic interactions and the r_1 values become invariant to *pH* variations and numerically equal to those under unionized state. The r_1 values for MA systems are higher than those for AA systems at low *pH* owing to the formation of plurimolecular aggregate by hydrophobic interactions between the methyl groups in the former. Addition of 1 M NaCl breaks down these aggregates and the r_1 drops to a lower value.

Recently, a phenomenological equation proposed by Kelen and Tudos (K-T) for the evaluation of mrrs was shown to be the most reliable form of the differential methods for the low-conversion data. The binary copolymerization equation tends to become inapplicable if the reacting system has irregularities arising from intra- and intermolecular interactions between the reacting species. In the copolymerization of ionizing monomers in aqueous solution, in addition to the free-radical reactivities, which control the composition and rate, electrostatic charge interactions between the ionized carboxyl groups are also present. The high conversion copolymerization data were tested by K-T procedure for their applicability. A comparison with those computed from the standard integration equation showed that except for cases of conversion higher than 40% the deviations were within experimental limits.

As a synthetic model for globular proteins, polymethacrylic acid has been extensively investigated. The molecule is present in a collapsed globular conformation stabilized by hydrophobic interactions between the methyl groups at low degrees of ionization $\alpha \leq 0.3$ expanding to random coiled state at higher side chain ionization $\alpha > 0.3$. The nature of the stabilizing factors (whether cooperative, short range or long range) in the compact state at lower ionizations was in dispute. Copolymers with varying sequence lengths of methacrylic acid interposed between a single unit of N-vinyl pyrrolidone were prepared and the free energy of conformational transition from the globular to random coiled state were determined by potentiometric titration and viscometry. The stabilizing factors were shown to be cooperative in nature.

Shri Ponrathnam was awarded the Ph.D. degree of Poona University for his thesis based on the studies.

Sewage Disposal in Greater Bombay : NEERI Project Report

The National Environmental Engineering Research Institute (NEERI), Nagpur, has prepared a report on Sewage Disposal Project for Greater Bombay. This report forms part of the project relating to the preparation of a master plan for water supply and sewage disposal of Greater Bombay for a period covering the seventies and extending up to 2000 AD. The consultants engaged for the project were Metcalf & Eddy of USA and Environmental Engineering Consultants of Bombay. The specific role of NEERI in the project was to provide consultancy services in selected areas, viz. land application of sewage and sludge, design criteria for sewage treatment plant units and literature review. NEERI started work in August 1976 and completed it in April 1977.

According to the report, an area of about 32,900 hectares in the Bhivandi

taluka is a potentially cultivable land. Studies on the physical and chemical characteristics of sewage effluent and sludge from Dadar, Dharavi and Ghatkopar treatment plants showed that the effluent was of a quality suitable for irrigation of all crops, while the effluents from the Worli, Colaba, Versova and Khar plants were of a relatively higher conductivity and sodium content and hence suitable only for salt-tolerant crops. The high electrical conductivity and chloride content of sewage samples from some of the treatment plants were attributed to the infiltration of saline water into some of the sewers. The report recommends measures to prevent, or at least reduce, the infiltration in order to guard the quality of sewage for irrigation and also stresses the need to have regulations on the discharge of liquid wastes from industries in Bombay.

With regard to the utility of sewage for irrigation purposes, the report provides detailed information on cropping patterns and brings out how crops of paddy, sugarcane, fruits, vegetables, fodder and essential oil-bearing grasses can be profitably cultivated. The report contains information on the impact of sewage irrigation on the health of the community. It is suggested that irrigation with sewage effluents is not advisable for vegetables that are eaten raw. It has been recommended that sewage be given secondary treatment before use for irrigation in such cases.

Another interesting feature of the report concerns the study carried out at NEERI on the utilization of domestic waste-waters for fish culture. The effluent from stabilization ponds was found to contain a rich crop of phyto and zooplankton, which form the natural food of fishes. The species of Indian fish used for the culture experiments were *Cyprinus carpio* (common carp), *Heteropneustes fossilis* (singhan), *Clarias batrachus* (weghoor) and *Channa marulius* (murrel).

Management of R & D Institutions : Seminar Proceedings

The proceedings of the seminar on Management of R&D Institutions, organized by Unesco in collaboration with the Centre for the Study of Science, Technology and Development (CSSTD), from 1 to 10 Aug. 1976 in Bangalore, have been published in two parts recently by CSSTD. Part I includes the proceedings of the inaugural and final sessions, a chapter on science organization in the participating countries, discussion on the theme papers and recommendations. Part II contains papers presented at the seminar. An account of the seminar has been published in *CSIR News*, 26 (1976), 129.

Enquiries regarding the publications may be addressed to Prof. A. Rahman, Head (CSSTD), Council of Scientific & Industrial Research, Rafi Marg, New Delhi 110001.

PROGRESS REPORTS

NBG Progress Report : 1973-75

The National Botanic Gardens (NBG), Lucknow, has published a three-year progress report for the years 1973, 1974 and 1975. The report (vi + 134 pages + 10 plates) shows that the laboratory investigated 42 research projects under seven multi-disciplinary areas, viz. Introduction, conservation and documentation of germplasm; Medicinal and aromatic plants; Non-agricultural industrial seed resources; Ornamental plants; Other economic plants; Economic utilization of 'usar' soils; and Other areas.

Consequent on a critical reappraisal of the aims and objectives of the laboratory, a thorough review of its research activities and research projects was made.

Considerable success was achieved in the field of floriculture, in which NBG's research programme is aimed at providing a scientific base, novelty and improvement to the multi-crore

rupee nursery trade. More than 40 new cultivars of eight well-known ornamental plants, viz. amaranthus, bougainvillea, chrysanthemum, perennial portulaca, rose, marigold and tuberose, were developed besides the September-October blooming varieties of chrysanthemum. New methods for training chrysanthemum were adopted and a process perfected for the dehydration of fresh flowers and foliage in such a manner as to retain their original shapes, sizes and colours for a sufficiently long time. Artistic greeting cards designed, made and marketed by NBG, using different types of dried flowers and foliage, were well received by the public.

Varietal collections of ornamental plants, particularly of bougainvillea, cacti and succulents, canna, chrysanthemum, dahlia, gladiolus, nymphaea and rose, were considerably enriched. A new arboretum was being set up.

Pharmacognostic studies were carried out on a large number of indigenous drugs belonging to the family Apocynaceae, and Indian species of *Polygonum*, besides the screening of about 600 plant samples for active principles. As a result, a large number of new sources of saponins, flavonoids and alkaloids were discovered.

A method was also developed for the mass propagation of the medicinal plant *Dioscorea floribunda* through tissue culture, which could ensure the supply of thousands of *D. floribunda* seedlings, within a short time of 2-3 months, for large-scale cultivation.

Processes were also developed for the mass propagation of virus-free citrus and chrysanthemum through tissue culture. Methods for forecasting productivity, for inducing early ripening and for treating mineral deficiencies of grapes were developed and were well received by orchardists. Techniques for small-scale cultivation of two edible mushrooms—the white mushroom (*Agaricus bisporus*) and the paddy straw mushroom (*Volvariella volvacea*)—were standardized.

The report also gives an account of two botanical expeditions to hitherto

botanically unexplored areas of Madmaheshwar and Tung Nath, lying between the rivers Mandakini and Alaknanda, in the Uttarakhand Hills of Uttar Pradesh in August 1974 and September-October 1975. The two expeditions made a rich haul of locally growing medicinal, wild ornamental and other economic plants, certain rare plants, lichens, ferns, etc. besides making a general floristic survey of the areas.

NBG's services in regard to the identification of plants, herbarium consultation, landscaping and garden layout were availed of extensively by parties. Since 1974, NBG has been conducting an annual training course

in modern techniques of chrysanthemum culture during July-August. Besides its usual two annual flower shows—Chrysanthemum and coleus show, and Rose and gladiolus show—NBG organized for the first time, on 4 & 5 October 1976, a house plants exhibition.

During this period, the scientists of NBG published 202 research papers and 28 popular articles, besides writing three books. The publication of NBG Bulletins was revived with the issuing of a bulletin on chrysanthemum. Thirteen members of staff obtained their Ph. D. degrees and seven scientists were deputed abroad under various exchange programmes.

CSIR SUPPORT TO RESEARCH

New Schemes

Reinforced Earth Embankments

A new CSIR research project granted to Prof. M. Venkata Ratnam and Dr G. Subrahmanyam of the Regional Engineering College, Warangal, envisages the study of some of the fundamental aspects of design, construction and performance of a full-scale 'reinforced earth' embankment subjected to field loading conditions. The investigators propose the raising of the height of the existing 1.5 m high reinforced earth embankment with sloping approaches on either side to a height of 3 m along with the corresponding increase in length of the sloping approaches. The embankment is to be constructed in layers having a depth of 25 cm of soil reinforced with 10 cm wide G. I. strips of adequate length extending from the sides into the centre of the embankment and is provided with a skin element of G.I. sheet made into an elliptical shape with its major axis vertical. The reinforcing strips are to be placed at the joint of skin elements of adjacent layers and connected by bolts and nuts.

The reinforcing strips in the instrumented section (extending over about

0.5 m across the full width of the embankment) will be provided with strain gauges connected by shielded wire to the nearby instrumentation house. Also, pressure cells will be installed to measure the earth pressures on the skin elements at different elevations. The total pullout resistance of the reinforcing strip in relation to shear strength will be estimated and verified by conducting pullout tests at selected places after considerable lapse of time. The properties of the soil and material of reinforcing strip will also be determined.

During the later part of this study it is proposed to investigate the feasibility of adopting other materials such as fibre reinforced glass/fabrics/synthetic materials for the reinforcing strips and concrete (nominally reinforced) blocks for skin elements so that they may be preferred to G. I. sheets where corrosion and weathering might pose a problem.

The tension developed in the strips and pressures exerted on the skin elements will be estimated on the basis of measured properties of materials used and intensity of traffic loads expected. These predicted values will be compared with actual measured values either to prove the validity of

analysis or modify the method of analysis for better correlation.

At present, reinforced earth embankments are being constructed only in a few countries such as France, USA and Italy. These embankments have not so far been constructed in India. They will undoubtedly be a boon in constructing embankments such as (i) approaches for a road overbridge in built-up areas of towns and cities, (ii) approach embankments to national highways across railway lines, and (iii) formation of roads along hill slopes in the cross country as well as in developed areas. Considerable economy could be effected by cutting off the side slopes of embankments by making use of reinforced earth, in addition to saving high costs of acquisition of neighbouring land.

It is particularly interesting to study the variation in these parameters with the passage of time, and the consequent increased intensities of traffic loads to ensure long-term satisfactory performance.

Reinforced earth embankment is important because of its adaptability in poor foundation soils (soft and weak) where large differential settlements rule out the use of conventional piers and inclined R. C. slabs for the approaches. Also, it helps in avoiding the digging into the subsurface, which may pose problems of dislocation of essential services lines, etc., especially in urban areas.

Completed Schemes

Karyological Studies on Some Indian Reptiles

The karyotype characterized by the number of chromosomes, their size and morphology is a definite and constant character of each species. Since the genetic material is carried by the chromosomes it could be deduced that the genome has a specific pattern of its own. The karyotype exhibits more or less pronounced changes within different groups and may have, like other morphological features, phylogenetic implications.

In spite of their important taxonomical and evolutionary status, only a fraction of the vast reptilian fauna has so far been investigated cytologically. This is primarily due to some of the technical difficulties which this group of animals shares with the aves. However, recent technical advances in mammalian cytogenetics have greatly promoted karyotypic studies in these lower vertebrates.

Recently the ophidians have attracted the special attention of cytogeneticists regarding the sexual dimorphism of their chromosomes. Available information indicates that there is a step-by-step sex-chromosome differentiation from the morphologically undifferentiated condition to the grossly differentiated status. Other karyological manifestations observed in snakes are the discovery of W-chromatin in the interphase nuclei and asynchrony in the replication pattern of W-chromosome.

Lizards have displayed many advanced variations to the XY/XX type of the sex-determining mechanism such as the $X_1X_2Y/X_1X_1X_2X_2$ and its complex transformation into the "pseudo XO/XX" type of mechanism.

Karyological studies on some Indian reptiles were undertaken by Miss Usha Nakhasi at the Panjab University, Chandigarh. A number of species of reptiles from localities as varied as Assam, Meghalaya, West Bengal, Maharashtra, Karnataka, Goa and Punjab were analyzed during the investigations.

Latest cytogenetical techniques with necessary modifications related to the diurnal changes for different tissues for the two sexes and at different seasonal temperatures have been made use of to get the best possible results.

The present investigations have revealed genotypic and karyotypic variations, exhibited by intraspecific polymorphic populations, satellites, persistent secondary constrictions, polyploid nuclei and a few reliable factors responsible for varied types of sex-determining mechanisms. The statistical study has further shown that the most plau-

sible explanation for similar but varied types of karyotypes is para- and pericentric inversions, occasional intra-chromosomal translocations, and rare instances of centric fissions leading to the evolution of different groups.

The results of the study have been helpful in furnishing clues to the solution of the problem of taxonomy on the basis of prevailing cytogenetical evidence.

Based on the investigations Miss Nakhasi has submitted a thesis for the Ph. D. degree of the Panjab University.

PERSONNEL NEWS

Appointments/Promotions

Dr A. S. Rao

Dr A. Somasekar Rao of the National Chemical Laboratory (NCL), Poona, has been appointed, on promotion, Scientist EI with effect from 23 July 1974.

Dr Rao (born 18 Feb. 1929) obtained his B.Sc. (Hons) degree in chemistry from the Madras University. He worked in the Indian Institute of Science, Bangalore, wherefrom he obtained his A.I.I.Sc. (1951) and Ph. D. degree (Bombay, 1954). Dr Rao joined NCL in 1957. He has guided nine Ph. D. students and is the co-author of 70 papers dealing with stereochemistry, examination of essential oils, terpenes, steroids, oxiranes, reactions of lead tetra-acetate and synthetic organic chemistry with special reference to development of novel routes. The structures of costunolide, saussurea lactone and ferenenol have been determined by him. He has established the stereochemistry of levojunenol and absolute configuration of ar-turmerone, an important constituent of turmeric. He has also studied the stereochemistry of epoxidation of *cis*-pulegol and some addition reactions of carvone. The sesquiterpenes, β -elemene, elemol carissone, tauremisin, saussurea lactone, ar-curcumene and β -eudesmol have been synthesized by him. He has extended the use of lead tetra-acetate as a rea-

gent in organic synthesis. A new route has been developed by him for the degradation of side-chain of bile acids, which is an essential operation for the conversion of bile acids to medicinally important androstane and pregnane derivatives. He has developed new methods for the preparation of arylvinyl ketones, α -acetoxyaldehydes and α -methylene lactones, a class of compounds which has attracted considerable attention as antitumour agents. A convenient method for the preparation of a key intermediate for the synthesis of the antihypertensive drug, methyl-dopa, has also been developed.

In collaboration with other NCL scientists Dr Rao has developed processes for the manufacture of the perfumery compounds citronellol and geraniol and the organophosphorus pesticide phenthroate; these processes are being used commercially. He has developed, along with coworkers, processes for the drugs theophylline, aminophylline and caffeine.

Dr Rao worked as a post-doctoral fellow in the Boston University (1961-62) on the stereochemistry of podophyllotoxin and in the Rice University (1962-63) on the synthesis of diterpene alkaloids.

Dr S.C. Sethi

Dr S.C. Sethi of NCL, Poona, has been appointed, on promotion, Scientist EI with effect from 10 May 1975.

Dr Sethi (born 13 Sep. 1927) had his early education at Ajmer and took his B.Sc. (1946) and M.Sc. (Tech.) (1948) degrees from the Banaras Hindu University, Varanasi. He joined the Chemical Laboratory of CSIR in August 1948 and was transferred to NCL in 1949. He was awarded the Ph.D. degree (1961) of the Poona University for his thesis on natural and synthetic antioxidants for edible fats and utilization of cashewnut shell liquid. Sethi worked with Prof. H.C. Brown at the Purdue University, USA, under a post-doctoral research fellowship. During this period (Oct. 1963 to March 1966) he developed a new and

rapid method for the quantitative determination of unsaturation via hydrogenation and studied the contrathermodynamic thermal isomerizations of alkyl boranes.

With a view to developing some non-toxic antioxidants and determining the effect of spices on the stability of edible oils, Sethi made a systematic study of the common Indian spices and demonstrated that some of the active ingredients were responsible for the extended shelf-life of treated oils, the maximum antioxidant activity being shown by hydroxychavicol present in betel leaves.

In a series of papers Sethi has proved the suitability of cardanol, the major constituent of abundantly available cashewnut shell liquid, for the production of industrial surface-active agents and heat exchange liquids.

Dr Sethi has developed a process for the production of *p*-menthane hydroperoxide, a low-temperature polymerization catalyst for styrene-butadiene. He has also developed processes for the production of terpineol, and some plant growth regulators. This has enabled the production of all these compounds in the country, which were otherwise being imported.

Dr Sethi has published more than 25 research papers and a number of technical reports. He is at present engaged in photochemical studies and oxidation behaviour of organic compounds.

Shri S.P. Mukherjee

Shri S.P. Mukherjee of NCL, Poona, has been appointed, on promotion, Scientist EI at NCL with effect from 1 April 1976.

Shri Mukherjee (born 1 Jan. 1932) obtained his bachelor's degree (1954) in chemical engineering from the Jadavpur University. After a year's industrial experience, he joined the Indian Institute of Technology, Kharagpur, where he was engaged for about three years in research and teaching.

Shri Mukherjee joined the chemical engineering division of NCL in Decem-

ber 1958. He is currently working on process development and pilot plant investigation with emphasis on chemical engineering principles as applied to industrial reactor design. His principal fields of interest are gas-solid, gas-liquid reactions and fluidization.

As a project leader Shri Mukherjee has been responsible for the development of eleven processes of which eight have been taken up by industries. Four of these, viz. chloromethanes (Standard Alkali, Bombay), chlorobenzenes (Hindustan Organic Chemicals, Rasayani), dimethylaniline (Sahyadri Dye-stuffs, Poona), and opium alkaloids (Government Opium and Alkaloid Works, Neemuch) are already in production. He has also assisted in commissioning these plants and in troubleshooting.

Shri Mukherjee worked on liquid-liquid extraction in a pulsed column at Institut du Génie Chimique, Toulouse, France, during 1965-66. He has ten research papers and two patents to his credit.

Dr R. M. Joshi

Dr R. M. Joshi of NCL, Poona, has been appointed, on promotion, Scientist EI with effect from 1 April 1976.

Dr Joshi (born 23 Jan. 1923) obtained his bachelor's degree (1944) from the University of Bombay, after which he worked in various food testing laboratories of the Defence Services till he joined NCL in 1951. He obtained master's degree (1956) from the Poona University and Ph. D. (1963).

Proceeding to USA during 1964-67 on a Robert A. Welch Foundation (Texas) postdoctoral fellowship, Dr Joshi worked at the Thermodynamics Research Center, Texas A & M University, on thermochemical and thermodynamic aspects of polymerization reactions and polymers. Dr Joshi has several noteworthy publications on vinyl polymerization and copolymerization, including a chapter in the book 'Vinyl Polymerization', Vol. 1 Pt. I (Dekker, 1967). He also contributed, by invitation, a section 'Thermodynamic pro-

erties of monomers and polymers' in the Encyclopedia of Polymer Science and Technology, Vol. 13 (Interscience-Wiley, 1970). Dr Joshi's theory on the solvent effect in free-radical copolymerization has been accepted after a long controversy. He is at present engaged in formulating a new bond-energy scheme for calculating thermodynamic properties of polymers, five parts of which have already been published.

Dr Joshi has worked on synthetic ion-exchange resins (polystyrene base) leading to their production for the first time in the country. He has also initiated a project on the production of speciality synthetic rubbers (Hypalon type) from indigenous raw materials.

Dr S.N. Kulkarni

Dr S.N. Kulkarni of NCL, Poona, has been appointed, on promotion, Scientist EI at NCL with effect from 18 December 1976.

Dr Kulkarni (born 22 Feb. 1930) obtained his B.Sc. (Hons) (1951), M.Sc. (1953) and Ph.D. (1956) degrees from the Karnatak University. After working as a research assistant at the Karnatak University from 1953 to 1956, he proceeded to UK and obtained another Ph.D. (1960) degree from the Exeter University. His work there was mainly concerned with the synthesis of cystine peptides with the ultimate aim of synthesizing the 'loop' of the insulin molecule. Returning to India, Dr Kulkarni joined NCL as Pool Officer in July 1960 and as Scientist B in December 1963.

At NCL, Dr Kulkarni started his work in natural products chemistry. Continuing his work in terpene chemistry he synthesized compounds like (-)- α -curcumene, (+)-calamenene, (+)-epizonarene and 7-hydroxycalamenene. Recently he has started working on the synthesis of hydrocyclic compounds of pharmacological interest. He is also investiga-

ting the stereochemistry of the isopropyl group in the synthesis of natural terpenoids. He has worked on a number of applied projects, some of which have gone into production.

Dr Kulkarni is the co-author of 36 papers, and has guided a number of Ph.D. students.

Indian Journal of Pure & Applied Physics

Raman Effect Golden Jubilee Number

The Publications & Information Directorate, New Delhi, is bringing out the March 1978 issue of Indian Journal of Pure & Applied Physics as 'Raman Effect Golden Jubilee Number'. This issue will contain invited articles from leading scientists the world over on Raman spectroscopy, laser Raman studies, lattice dynamics, and chemical physics in general. The contributions will be in the form of significant new

findings as well as critical review articles.

This special issue will be supplied at no extra cost to regular subscribers of the journal for 1978 (annual subscription, Rs 100 or £ 16.50 or \$ 42.00). Single copies of this special issue have been priced at Rs 25.00 or £ 4.00 or \$ 10.00.

Orders for annual subscription for 1978 or for this special issue may be placed in advance with : Sales & Distribution Officer, Publications & Information Directorate, Hillside Road, New Delhi 110012.

PATENTS FILED

116/Del/77 : Improvements in or relating to a process for obtaining alpha aroyl hydrazines, P. R. Adhikary, R.C. Bharadwaj, C.M. Gupta & P.C. Jain—CDRI, Lucknow.

COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH

Advertisement No. 21/77

It is proposed to appoint a Director for the Central Road Research Institute, New Delhi.

Job Requirements: This is a top R & D management post in the field of highway engineering. The Director is expected to provide leadership in the identification and formulation of research and development programme/projects and coordinating research and extension activities in accordance with the charter of the laboratory. The major areas of R & D activity at the Central Road Research Institute are flexible pavements, rigid pavements, composite pavements, traffic and transportation engineering, bridge engineering, soil mechanics & foundation engineering, surface characteristics of pavements, etc. The selected candidate is expected to have intimate knowledge about the highway development activities in India and other countries. He would also develop close rapport with the user industries/departments/agencies. The candidate is expected to be an acknowledged leader of the profession with ability to project an objective image of the institute.

Qualifications and Experience: High academic qualifications in engineering, preferably highway engineering. Good experience in planning, construction and/or research on roads and ability to direct research and/or operational projects in this field.

Salary/Conditions of Service: The salary scale attached to the post is Rs 2500-125/2-3000. Initial pay will be fixed according to merits. The person selected will be appointed on contract for a period of six years subject to confirmation of the contract after two years of satisfactory service. Other conditions of contract will be supplied on request.

Age Limit: Below 50 years, relaxable in special cases. Scientists/Technologists interested may obtain a standard proforma for sending their *curriculum vitae* from Chief (Administration), Council of Scientific & Industrial Research, Rafi Marg, New Delhi 110001. They can also obtain a brochure on the aims and objects and the latest annual report of the institute.

The completed *curriculum vitae* proforma must be received in this office on or before 14 December 1977.

Canvassing in any form and/or bringing in any influence, political or otherwise, will be treated as a disqualification for the post.